

1

## REMOTE MICROPHONE AND RANGE-FINDING CONFIGURATION

This application is a continuation of application Ser. No. 08/949,070, filed Oct. 10, 1997, now U.S. Pat. No. 5,995,763.

### FIELD OF THE INVENTION

This invention relates generally to remotely operable electronic apparatus. In particular, the invention may be applied to distance measurement and picture/sound recording wherein, for example, a remote unit may be equipped with a microphone and an active range finder coupled to an auto-focussing capability.

### BACKGROUND OF THE INVENTION

Picture recording apparatus such as video recorders have become extremely sophisticated in recent years, and now produce high-resolution images with great clarity even in consumer products. Modern camcorders now include a high-resolution recording medium, and may feature an electronic zoom, image stabilization and other advanced capabilities.

As improvements in image quality have advanced, however, audio recording quality has lagged behind. Although the audio recording circuits associated with such recorders offer high fidelity, and typically, stereophonic sound, the microphone is fixed at the location of the camera body. As such, when the audio source is located any appreciable distance from the recording unit, the effect of distance, wind and other factors significantly degrade sound quality.

One solution to this problem is through the use of a remote microphone, which may be obtained from a number of sources, including wireless versions. Depending upon cost, such devices offer varying sophistication, and, at the high end, afford very reliable and clear reception from a remote audio source.

As camera manufacturers presently do not offer integrated remote microphones with their picture recording units, however, consumers must resort to independent sources for such devices. One consequence is an operational configuration wherein a number of functional units are interconnected by different wires, which tend to get in the way or become entangled. For example, the typical commercial remote microphone comes with a wireless transmitter, adapted to be carried by an individual to be recorded. The transmitter communicates with a wireless receiver unit which interconnects to the camera by way of an audio cable. The receiver unit is often worn on the person of the individual carrying the camera, with the wire between the receiver and camera being dressed on or around this individual as well.

The need remains, therefore, for an integrated camera and wireless remote microphone arrangement, for use with either moving or still imagery, which enables a microphone to be docked for non-remote use, and removed for remote use without the need for equipment reconfiguration. The need also exists for a remote microphone including circuitry in support of an auto-focusing capability, preferably through the use of an active ranging function to minimize at least some of the problems now experienced with passive auto-focus systems. Ideally, the circuitry associated with the remote microphone and the auto-focusing capability will be at least partially redundant so as to realize an elegant, cost-effective configuration. There is yet a further need for

2

a range-finding arrangement wherein a relatively slow signal such as an acoustic signal is utilized and at a least a first direction, with an electromagnetic signal being preferably used in a return path carrying a representation of the acoustic signal in modulated fashion to realize an inexpensive approach to various distance-measurement functions including surveying, and so forth. This latter need may also be served according to the invention through the integration of a remote microphone along with the range-finding function to permit one- or two-way voice communication during a measurement operation.

### SUMMARY OF THE INVENTION

One embodiment of the present invention uses time-of-flight distancing to focus a camera, whether for still or motion picture taking. Broadly, a camera is adapted to transmit a signal to a remote transponder unit which returns a signal enabling the camera to accurately calculate distance and adjust focus accordingly. In this embodiment, the transponder preferably forms part of a wireless microphone, the signal transmitted by the camera being acoustical in nature. A return signal is preferably sent back to the camera in RF form, enabling distance to be determined as a function of delay. The acoustical signal transmitted by the camera is preferably modulated onto the return RF signal, enabling at least a portion of the audio circuitry associated with voice modulation to be used for the purpose of modulating the ranging signal, thereby realizing a very efficient and economical approach to remote sound detection and active ranging finding. Even in the absence of remote sound detection, the inventive combination of an acoustical signal in a first direction modulated onto an RF carrier in the opposite direction represents a cost-effective solution to other distance-measurement applications such as dimensioning, surveying and so forth.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A illustrates, from an oblique perspective, a camera and removable remote unit according to the invention;

FIG. 1B illustrates the camera of FIG. 1A with the remote unit being detached and available for use both as an audio pick-up and for optional active ranging;

FIG. 2A is a block diagram depicting major electrical subsystems associated with a remote unit of the type shown in FIGS. 1A and 1B;

FIG. 2B is a block diagram depicting major electrical subsystems associated with a camera adapted to communicate with the remote unit of FIG. 2A;

FIG. 3 is a drawing which shows distance-measurement apparatus which utilizes an acoustical signal in one direction and an electromagnetic signal in the opposite direction for range-finding purposes;

FIG. 4A is a drawing of an embodiment of the invention as seen from an oblique perspective showing how a plurality of antennas may be used in conjunction with a received signal for the purpose of providing an automated camera pan function;

FIG. 4B is a block diagram depicting certain of the control circuitry associated with the embodiment of FIG. 4A; and

FIG. 5 is a drawing of an embodiment of the invention as seen from an oblique perspective showing how more than two antennas may be used to effect an automatic pan/tilt capability.

### DETAILED DESCRIPTION OF THE INVENTION

According to one aspect of this invention, a remote unit incorporates a microphone while providing, in combination,